

TAB C

### Attachment C

## **GIS-based Estimates of Wetland Extent and Wetlands Impacts from the Proposed Pumping Plant in the Lower Yazoo Backwater Area**

Wetland delineations are traditionally, and most accurately, done on an on-site basis following the 1987 Corps of Engineers Wetland Delineation Manual. However, in the case of the large federal flood control projects in the Yazoo Basin, surrogate methods for the estimation of wetland extent have been employed. It must be understood that estimation techniques based on remotely-sensed data are never as accurate as on-site techniques, and in the case of significant impact to national wetland resources, on-site techniques are preferred to fully document potential wetland loss and impact.

Additionally, the Lower Yazoo Backwater Area is a very complex landscape—a topographic mosaic of flat land where small elevational differences can have important effects on water movement, ponding and drainage. These elevational levels are key to the determination of where wetlands occur on the landscape.

To further complicate the situation, there is insufficient information and data in the Lower Yazoo Basin to comprehensively state the extent of wetland acreages. For example, no digital soil series information or current cropping information exists for the Yazoo River Basin. However, even given these limitations, and in an effort to more fully understand the possible impacts of the Backwater Pumping project, the following describes a GIS-based analysis done at a landscape-level scale used to estimate the extent of wetlands in the Yazoo Backwater Area. Additionally, we have commented on probable wetland acreage impacts that would occur with the proposed pumping operation to 87 feet. These GIS-based methods do not provide a definitive, detailed analysis on wetland extent and impacts, however, the examples given do provide an estimate based on surrogate, landscape-level indicators of wetland extent, and compares these to the Corps of Engineers-Vicksburg District estimates provided in the Draft Environmental Impact Statement for the Yazoo Backwater Area (EIS). At this time, no agency or organization has a comprehensive and site-specific analysis of wetland extent for the lower Yazoo Backwater project area.

### **1. GIS estimates of wetland extent within 2-year (91') floodplain elevation meeting hydrology and soils criteria:**

#### **Background:**

Given the amount of information and databases available for this basin, we determined that a conservative analysis of wetland extent should be based on the extent of the 2-year floodplain and the presence of hydric soils (wetlands extent above the 2-year floodplain was also determined and is discussed in section 2). The Corps of Engineers 1987 Manual states that “an

area has wetland hydrology if it is inundated or saturated to the surface for at least 5 percent of the growing season in most years.” The only available surrogate information that was available at the time of our analysis was a nominal image of the 2-year flood event. In addition, because the presence of hydric soils is another important criteria for determining wetland extent, we also used a hydric soils GIS coverage.

The following information is based on the Corps Vicksburg District nominal 2-year satellite image/land use provided to USGS-Pearl, Mississippi in 1998. This nominal 2-year image is a composite of two satellite scenes that were taken when the Steele Bayou gage approximated a 2-year flood (90.6' on 1-30-74 and 89.7' on 3-10-89). This composite image was also combined with a land use classification coverage (based on 1988 imagery). The total acreage amount within the Corps 2-year nominal satellite image was then overlain with a GIS layer for hydric soils in the project area (provided by U.S. Army Engineer Research and Development Center, formerly Corps Waterways Experiment Station). The resulting acreages provide an estimate of cropped and forested wetland extent within the 2-year floodplain based on inundation events.

There are several key limitations to the use of this nominal 2-year flood image that should be taken into account. This method does not comprehensively account for wetlands that occur due to ponding and saturation. Also, the images used were at elevation levels below 91 feet, the elevation that the Corps states is the 2-year flood; and the image analysis was an unsupervised classification (not checked against photo-interpretation or field inspection); and the land use data was over ten years old. Therefore, although this information has allowed us to provide an acreage amount of wetland extent within the 2-year floodplain, this must be considered as a conservative estimate only.

#### **Wetland Extent: Estimations for Wetlands within the 2-year Floodplain:**

- There are 96,518 acres of forested wetlands within the 2 year floodplain, based on the Corps nominal 2-year flood image, overlain with hydric soils.
- This is a landscape-level, remote assessment, and not a detailed analysis in combination with field-level assessment.
- This method underestimates wetland extent as it does not comprehensively assess ponding, and does not assess saturation at all.
- This assessment does not include the estimate of additional wetlands acres that exist above the 2-year floodplain. This is addressed in the next section.
- There are approximately 76,827 acres of cropped wetlands within the 2-year floodplain. Of that total cropped lands acreage, there were approximately 45,000 acres of soybeans and 23,000 acres of rice classified on the land use image during the 1988 growing season. The fact that 89% of the farm land was planted in crops which have a short growing season (soybeans) or are somewhat water tolerate (rice), lends credence to the idea that most of the land in the two year floodplain, on hydric soil, is in fact wetland area. Site-specific field assessment would be required to determine if drainage ditches or other forms of improved drainage have altered the hydrology on these cropped wetlands as identified at a landscape-level. It should be noted that less than 3% of



the land within the 2-year floodplain was classified as supporting cotton and corn, which are crops normally planted on well-drained, infrequently flooded areas.

-This assessment does not provide direct information on duration, specifically identifying lands that are inundated for 15 consecutive days. The criteria (Food and Security Act) for farmed wetlands is "inundation for 15 consecutive days or more during the growing season in most years."

-This is a conservative acreage figure, because the satellite scenes used for the composite nominal image were taken at a time when the gage reading did not reach 91', the elevation of the 2-year flood (according to Draft EIS, page 6-36).

### **Wetland Impacts: Estimations of wetland impact within the 2-year floodplain due to a pumping plant operating at 87':**

-Based on this method, it is anticipated that the pumping plant operating to 87' will result in hydrologic impacts to 96,518 acres of forested wetlands and 76,827 acres of cropped wetlands within the 2-year floodplain.

-**Important**—this estimate does not include the additional anticipated impacts above the 2-year floodplain.

-Hydrologic changes resulting from the pumping plant at 87' will include a combination (not quantified) of the following impacts:

- loss of jurisdictional wetland status due to the resulting stage reduction caused by pumping (according to Corps, the recommended plan #5 will reduce the existing stages at 91.0' in the Lower Ponding Area and 91.6' in the Upper Ponding Area to 87.8' and 88.9', respectively);

- some wetland acres will have a decrease in depth of inundation;

- some wetland acres will have shorter periods (decrease in duration) of both inundation and saturation;

- some wetland acres will have a decrease in frequency of inundation.

-To determine the anticipated loss of jurisdictional wetland status within the 2-year floodplain, we would need to know the acreage difference between 87.8' and 91' for the Lower Ponding Area; and 88.9' and 91.6' for the Upper Ponding Area (based on claimed stage reductions in Corps Table 6-9). That information was not available in the Draft EIS.

### **2. GIS estimates of wetland extent above the 2-year floodplain elevation (91') using hydric soils and topographic depressions:**

#### **Background:**



This methodology is also GIS-based, and combines information on flood frequency (lands above the 2-year floodplain), hydric soils, and topographic depressions. The topographic depressions data layer was developed by USGS-Pearl, MS,<sup>1</sup> and shows the locations of local sinks or depressions on the landscape within the study area. "Topographic depressions indicate places on the landscape where water is likely to pond because these are points of low elevation surrounded by points of higher elevation. Once water enters a depression, there is no outlet through which the water can drain, which causes the water to remain in the sink until evaporation and/or seepage occurs resulting in flood-water storage and possible interaction with ground-water resources." In short, these are areas that can support a natural wetland, due to long-term storage, lack of drainage, and very low permeability, clay soils. Site-specific field assessment would be required to determine if drainage ditches or other forms of improved drainage have altered the hydrology of these depressions as identified at a landscape-scale by this GIS method. Note—as in the above analysis of within 2-year floodplain, this analysis is not a site-specific, comprehensive analysis, as would be required under the 404 program, but rather a landscape-level tool appropriate for planning purposes.

In addition to the topographic depressions coverage, the same coverages used in method number one described above -- the nominal 2-year satellite image/land use provided by the Corps Vicksburg District, and the hydric soils provided by ERDC -- were also used with this methodology. We have given the resulting acreage figures, and statements of the benefits and limitations of this method below.

#### **Wetlands Extent: Estimations for Wetlands above the 2-year Floodplain:**

- There is a total of 96,180 acres of land above the 2-year elevation (91') that have hydric soils and occur within topographic depressions.
- This is a landscape-level, remote assessment and not a detailed analysis in combination with field-level assessment.
- This assessment does not provide direct information about duration, however hydric soils combined with depressional areas are good surrogates for areas of ponding. This method gives us an estimation of ponded areas above 91'.

#### **Wetlands Impacts: Estimations of wetland impact above the 2-year floodplain due to a pumping plant operating at 87':**

- Extensive wetland areas are present above the 2-year elevation level. With this landscape-level technique, we estimate that above the 2-year elevation (91') there are 96,180 acres that can potentially support a natural wetland, due to long-term storage, lack of drainage, and very low permeability, clay soils.

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<sup>1</sup>Documented in more detail in "A Decision Support System for Prioritizing Forested Wetland Restoration in the Yazoo Backwater Area, Mississippi," by O'Hara, Davis and Kleiss, U.S. Geological Survey Water Resources Investigations Report 00-4199, Sept. 2000.

-Above the 2-year elevation level, hydrologic changes resulting from the pumping plant at 87' will include a combination (not quantified) of the following impacts to these topographic depressions/hyric areas:

- some wetland acres will lose their jurisdictional wetland status;
- some wetland acres will have a decrease in depth of inundation;
- some wetland acres will have shorter periods (decrease in duration) of both inundation and saturation;
- some wetland acres will have a decrease in frequency of inundation.

-If a site-specific examination can show that some portion of these areas of topographic depressions/hyric soils will not be drained by the pumping plant, then it would also be erroneous to claim any economic flood protection benefits on these areas.

### 3. Final Conclusions:

There is an insufficient amount of information to comprehensively state the extent of wetland acreages within the lower Yazoo Basin project area. However, GIS methods allow for an estimation of the wetland extent at a landscape-level, and additionally allow for an estimation of anticipated hydrologic impacts due to a pumping plant operating to 87 feet. These GIS-based methods do not provide a definitive, detailed analysis on wetland extent and impacts, however, the examples given do provide an estimate based on surrogate, landscape-level indicators of wetland extent, and allows for a comparison to the Corps of Engineers-Vicksburg District estimates provided in the Draft Environmental Impact Statement for the Yazoo Backwater Area. The anticipated hydrologic impacts will include a combination some wetland acres losing their jurisdictional wetland status, and some wetland acres having impacts from decreases in the depth of inundation, in the duration of both saturation and inundation, and in the frequency of inundation.

Based on Method #1– we can anticipate hydrologic impacts to 96,518 acres of forested wetlands within the 2 year floodplain. Additionally, we can anticipate hydrologic impacts to 76,827 acres of cropped wetlands within the 2-year floodplain. Site-specific field assessments would be required to determine if drainage ditches or other forms of improved drainage have altered the hydrology on these cropped wetlands as identified at a landscape-level. The portion of these forested and cropped wetland acres impacted that would become non-jurisdictional cannot be quantified with the current available information, however, would include the acreages between between 87.8' and 91' for the Lower Ponding Area; and 88.9' and 91.6' for the Upper Ponding Area.

Based on Method #2 – we can anticipate hydrologic impacts to an additional 96,180 acres of land above the 2-year elevation. Site-specific field assessment would be required to determine if drainage ditches or other forms of improved drainage have altered the hydrology of

these depressions as identified at a landscape-scale by this GIS method. If a site-specific examination can show that some portion of these areas of topographic depressions/hydric soils will not be drained by the pumping plant, then it would be erroneous to claim any economic flood protection benefits on these areas.